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USE OF AN EDUCATION INTERVENTION IN IMPROVING BLOOD GLUCOSE MANAGEMENT IN PATIENTS UNDERGOING ALLOGENEIC BLOOD AND MARROW TRANSPLANTATION (BMT)

Ritzau, N., Wildridge, S., Shelburne, N., Feigenbaum, K., Aker, D. National Institutes of Health, Bethesda, MD

Poor glycemic control in patients undergoing BMT is associated with non-relapse mortality. Impaired immune function and infection related to hyperglycemia, as well as increased morbidity and mortality associated with hypoglycemia and glucose variability have been demonstrated. Medications utilized in the BMT population; e.g. steroids and immunosuppressive agents, combined with the conditions of neutropenia and type II or steroid induced diabetes mellitus, necessitates well coordinated blood glucose management in order to improve overall patient outcomes.

The 28-bed adult allogeneic BMT unit at the National Institutes of Health utilizes a Blood Glucose Management Service (BGMS), an interdisciplinary, evidenced-based team of experts, to manage glycemic control in this complex patient population. An analysis of point of care testing and medication errors around glycemic control revealed the majority of hospital wide errors occurred within the BMT population. From January through March 2009 the BMT unit alone contained 53% of all BGMS managed patients throughout the hospital. In the same time period the average error rate was 7% on the BMT unit, accounting for 91% of hospital blood glucose management errors.

An evaluation of these errors highlighted communication with the licensed independent practitioner and understanding of computer based orders for blood glucose monitoring and insulin as areas for improvement. BGMS emphasized the need for ongoing communication of patient changes, e.g. NPO status that require alterations in dosing to the licensed independent practitioner, and correct reading of real-time orders within the electronic medical record. An education intervention, consisting of in-services held by the BGMS and one on one targeted education of staff occurred in April and May, resulting in a decrease in error rates for June through August to an average of 2% on the BMT unit.

The successful implementation demonstrated by the drop in error rate on the BMT unit led the BGMS to expand the education intervention to additional hospital staff. Ongoing education of staff through yearly competencies and targeted sessions will continue in order to maintain a low error rate around glycemic control in BMT. Ultimately this should result in improved patient safety and clinical outcomes.

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A NOVEL APPROACH TO BENCHMARKING MEDICATION ERRORS IN PEDIATRIC TRANSPLANT CENTERS

Shepherd, C.A., Nieder, M.L. All Children's Hospital, St. Petersburg, FL

Optimizing patient outcomes is paramount in blood and marrow transplant programs. Although a multitude of risk factors certainly contribute, these are patient-based attributes that cannot be changed. However, reducing medication errors in the transplant population can positively impact morbidity and mortality. Once institutions have identified best practices for medication error reporting, benchmarking these data appropriately can inform decisions related to quality improvement. Much of the literature describing medication errors has historically relied on a metric involving a ratio of errors per medication doses dispensed. As with all programs, we review and analyze this information on a monthly basis. However, patient acuity is partly based on census and we believed that a more appropriate metric should include this variable. Therefore, in January 2009 we devised a new method for error analysis in our blood and marrow transplant patient population.

Error Rate = number of errors/(inpatient days) x 100

This rate is calculated monthly. We decided that 12 months of data would be sufficient for defining our baseline. After 8 months of trending, we have found the actual error rate to be 1.76 per 100 inpatient days. The monthly range has been 0.78 to 3.28. The data thus far have not suggested a trend toward increased medication errors occurring during higher census periods. In addition, we have not identified any specific trends related to error category types (eg A, B, C) and patient census. After 12 months of data collection, we plan to establish a baseline rate which can be utilized to determine our program benchmark. Strategies for improvement will center around error analysis and improving system processes. Because of the small numbers of actual errors, it will be necessary to collaborate with other pediatric transplant programs to validate this methodology and to develop error reduction protocols.

Medication Errors 2009

MONTH	# of ERRORS	INPATIENT DAYS	ERROR RATE
Jan	4	128	3.13
Feb	2	183	1.09
Mar	3	160	1.88
Apr	4	122	3.28
May	1	124	0.81
June	1	128	0.78
July	3	153	1.96
Aug	3	193	1.55
TOTAL	21	1191	1.76*

* Year-To-Date Error Rate

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CASE CONTROL STUDY OF LEVETIRACETAM VS. FOSPHENYTOIN FOR SEIZURE PROPHYLAXIS IN CHILDREN RECEIVING BUSULFAN (BU) FOR HEMATOPOIETIC STEM CELL TRANSPLANTATION (HSCT)

Skeens, M.A., Soni, S., Pai, V., Bajwa, R., Pietryga, D., Gross, T., Termuhlen, A. Nationwide Children's Hospital, Columbus, OH; The Ohio State University, Columbus, OH; The Ohio State University, Columbus, OH; The Ohio State University, Columbus, OH

Background Busulfan (BU) is utilized frequently for myeloablation in children undergoing hematopoietic stem cell transplantation (HSCT). A 7-10% incidence of seizures has been reported for patients receiving BU without any anti-convulsant prophylaxis. The PK profile of Levetiracetam is favorable as an anti-convulsant in this setting. This study compared levetiracetam and fosphenytoin during BU, examining the effect on busulfan levels, efficiency of administration (cost, nursing time, drug compatibility), and efficacy.

Methods We performed a retrospective case control study of fosphenytoin (n = 20) *vs.* levetiracetam (n = 27) use for seizure prophylaxis during BU conditioning regimens. Patients were matched by age, gender, diagnosis, and type of HSCT. All patients received BU at an initial dose of 0.8 mg/kg to 1 mg/kg, subsequently adjusted to an AUC of 800-1350 μmol/L based on first dose PK. Levetiracetam was given at 10 mg/kg/dose (maximum: 500 mg/dose) intravenously (IV) over 15 minutes every 12 hours. Initial doses were administered 6 to 12 hours prior to first dose of BU and continued at least 24 hours after the completion of BU. Fosphenytoin was administered as a loading dose (15 mg PE/kg) 12-24 hours before BU followed by age appropriate maintenance dosing with intermittent loading doses for subtherapeutic levels. Fosphenytoin was given as IV infusion (duration dependent on dose).

Results Median age for both groups was 8 years, with similar ranges. Both groups contained 15% autologous and 85% allogeneic HSCT. Two seizures occurred in the case control *vs.* none in the levetiracetam group. BU dose adjustments were required in 20/27 (74%) patients receiving levetiracetam and in 15/20 (75%) fosphenytoin patients to attain AUC goal. Levetiracetam was a shorter infusion, with no drug compatibility issues, level monitoring, or dose adjustments when compared to fosphenytoin. Cost analysis is pending.

Conclusion There is no previous report of using levetiracetam as a single agent for seizure prophylaxis during a BU conditioning regimen in pediatric HSCT patients. When compared to fosphenytoin, in this small number of patients, there were no seizures. Levetiracetam did not alter the frequency of BU dose adjustments and is more efficient to administer. Further, prospective trials using levetiracetam as a single agent to prevent BU induced seizures are needed.